REMARKS

Claims 1-17 and 19-21 are pending in the current application. In an Office Action dated February 9, 2006, the Examiner rejected claims 1, 2, 7, 9-12, 15-17, and 21 under 35 U.S.C. § 103(a) as being unpatentable over McDonald, U.S. Patent No. 5,212,471 ("McDonald") in view of Donath et al., U.S. Patent Application Publication No. 2004/0066376 A1 ("Donath"), rejected claims 3-4, and 8 under 35 U.S.C. § 103(a) as being unpatentable over McDonald in view of Donath and in further view of Weber et al, U.S. Patent Application Publication No. 2004/0135742 A1 ("Weber"), and rejected claims 5, 6, 10, 13, 14, 19, and 20 under 35 U.S.C. § 103(a) as being unpatentable over McDonald in view of Donath and in further view of Sebastiano et al., U.S. Patent No. 5,143,796 ("Sebastiano"). Applicants' representative respectfully traverses the above-listed rejections of claims 1-17 and 19-21.

As discussed in the current application beginning on line 33 of page 4, Applicants disclose in the current application three alternative combiner embodiments. The first combiner embodiment utilizes an optic designed to optimize Fresnel reflection while employing a polarization rotator. The second combiner embodiment utilizes an optic with dielectric coating and may also utilize a polarization rotator. A third combiner embodiment utilizes an optic with metallic coating to provide desired partial reflection and may also utilize a polarization rotator.

Claim 1 is representative of the current claims, and is provided below for the Examiner's convenience:

> 1. A visual display system that superimposes a virtual image onto a field of vision of an occupant of a vehicle that includes a windshield, the visual display system comprising:
>
> a display light source that transmits an image in at least partially polarized light; and
>
> a combiner positioned between the occupant and the windshield that transmits light from a field of vision external to the vehicle to the occupant, the combiner
>
> reflecting a first portion of the display light to superimpose the image as a virtual image within the transmitted field of vision,
>
> rotating the polarization of a second portion of the display light, and

> transmitting the second portion of the display light through the windshield, the second portion of the light having low efficiency for reflection towards the viewer from windshield-related optical boundaries encountered by the second portion of the display light following rotation of the plane of polarization of the display light and transmission by the combiner.

In claim 1, a display-light source directs an image projected in at least partially polarized light to a combiner positioned between the occupant of a vehicle and the windshield of the vehicle. The combiner transmits light from a field of vision external to the vehicle to the occupant and reflects a first portion of the display light to superimpose the image transmitted by the display-light source to the occupant as a virtual image within the transmitted field of vision. The combiner also rotates polarization of a second portion of the display light so that the second portion of the display light is transmitted through the windshield with high efficiency, reflecting light from the windshield surface towards the occupant with only low efficiency and thus attenuating or preventing secondary ghost images. Independent claim 13 also claims a combiner positioned between the occupant of a vehicle and the windshield of a vehicle, in the case of claim 13 coated with a metallic coating and reflecting a first portion of partially *p*-polarized light to the occupant and transmitting a second portion of the *p*-polarized light through the windshield without generating appreciable reflection from the windshield to the occupant. Independent claim 21 also claims a combiner, like the combiner of claim 1, with the addition of a relay optic that rotates the polarization of the light reflected by the combiner towards the occupant so that the occupant receives an image encoated in *p*-polarized light. The embodiment claimed in claim 21 is particularly useful for automobile applications in which occupants wear sunglasses, because *s*-polarized light is absorbed and filtered by polarizing sunglasses.

McDonald discloses a windshield-enclosed half-wave retarder (15 in Figure 1) that, combined with an inside or outside surface of the windshield of a vehicle, comprises a combiner for a head-up display. McDonald states, beginning on line 6 of column 2:

> Referring now to FIG. 1, shown therein is a head-up vehicle instrument

> display system that includes an imaging illumination source 20 located in a recess in the vehicle dashboard or on the dashboard, a beam-splitter combiner element 11 that comprises a combiner region of either the inside or outside surface of a vehicle windshield 13, and a half-wave retarder 15 which is interposed between the inside and outside air interfaces of the windshield in the region of the combiner element 11. By way of example, the half-wave retarder 15 is embedded between the layers or singlets of the standard safety windshield. (emphasis added)

McDonald's combiner comprises a vehicle windshield with an embedded half-wave retarder. In other words, the windshield of the vehicle is the combiner, and the embedded half-wave retarder is a polarization rotator. McDonald does not teach, mention, or suggest using a discrete combiner element for a head-up display.

By contrast Donath teaches a combiner for a head-up display that is separate from the windshield of a vehicle and interposed between the vehicle and occupant (42 in Figure 3B of Donath). Donath discusses the combiner and projection unit in Paragraph [0035]:

> Display 22 includes projection unit and one or more combiners which are described in greater detail later in the specification. Briefly, the projection unit receives a video signal from controller 12 and projects video images onto one or more combiners. The projection unit illustratively includes a liquid crystal display (LCD) matrix and a high-intensity light source similar to a conventional video projector, except that it is small so that it fits near the driver's seat space. The combiner is a partially reflective, partially transmissive beam splitter formed of optical glass or polymer for reflecting the projected light from the projection unit back to the driver. In one embodiment, the combiner is positioned such that the driver looks through the combiner, when looking through the forward-looking visual field, so that the driver can see both the actual outside road scene, as well as the computer-generated images projected onto the combiner. In one illustrative embodiment, the computer-generated images substantially overlay the actual images.

Donath continues, in paragraph [0036]:

> It should also be noted, however, that combiners or other similar devices can be placed about the driver to cover substantially all fields of view or be implemented in the glass of the windshield and windows. This can illustratively be implemented using a plurality of projectors or a single projector with appropriate optics to scan the projected image across the appropriate field of view.

In paragraphs [0045] through [0048], Donath provides additional details about the combiner. However, nowhere in Donath is polarized light mentioned, nor does Donath mention a polarization rotator, birefringent materials, or anything else related to polarized light or manipulation of polarized light by the combiner.

According to Section 2142 of the M.P.E.P:

> To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosures. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). See MPEP § 2143 - § 2143.03 for decisions pertinent to each of these criteria.

Applicants' representative can see no practical way to combine Donath and McDonald. In McDonald, the combiner is the windshield. A combination of McDonald and Donath would add a second combiner interposed between a viewer and the windshield. However, this second combiner, Donath's partially transmissive beam splitter, does not include a polarization rotator, and Donath neither teaches, mentions, nor suggests a polarized light source. In combining Donath with McDonald, one would need to choose either the polarized light source of McDonald or the non-polarized light source of Donath. If a non-polarized light source is used, then the half-wave retarder embedded within the windshield according to McDonald serves no purpose. Furthermore, that portion of the *un*polarized light transmitted through Donath's partially transmissive combiner would then impinge on McDonald's combiner, namely the windshield itself. At this point, additional reflection of *un*polarized light would occur, generating ghost images, as discussed in the current application with reference to Figure 2, which both McDonald's device and the currently claimed combiner are designed to avoid. This combination thus defeats the purpose of McDonald's disclosed head-up-display system.

If a polarizing light source is used, according to McDonald, then the light source would need to be *s*-polarized, as in McDonald, to be effectively reflected back to the viewer by Donath's combiner. That portion of the *s*-polarized light transmitted through Donath's partially transmissive combiner would then impinge on McDonald's combiner, namely the windshield itself. At this point, additional reflection of *s*-polarized light would occur, generating ghost images, as discussed in the current application with reference to Figure 2, which, again, defeats the purpose of McDonald's device. There is no way to substitute Donath's combiner for McDonald's combiner, since McDonald's combiner is the windshield, and Donath's combiner is separate from the windshield.

The problem in combining McDonald and Donath is that McDonald and Donath operate on entirely different principles. McDonald uses an *s*-polarized display-light source to generate efficient reflection from McDonald's windshield, and so that the half-wave retarder embedded in the windshield changes the polarization of the display-light-source light from *s*-polarization to *p*-polarization to prevent secondary reflections from the outside surface of McDonald's windshield. By contrast, Donath appears not to be concerned by secondary reflections and ghost images, does not teach, mention, or suggest a polarization rotator element or anything else related to polarized light, and. does not employ a polarized display-light source. There is simply no reasonable way to combine Donath with McDonald.

According to M.P.E.P. § 2142, the Examiner needs to show a suggestion for combining two references. McDonald does not make any suggestion for employing a combiner separate from the windshield and, in fact, is specifically directed to using a windshield surface as the combiner. Similarly, Donath makes no mention or suggestion of employing a polarized display-light source and a polarization rotator in combination with a combiner in order to prevent secondary reflection from interfaces that result in ghost images. Thus, there is no suggestion in McDonald or Donath for the combination recited by the Examiner. Moreover, as discussed above, there is no workable combination of Donath and McDonald. Finally, McDonald and Donath do not, in combination, teach all limitations of claim 1, as required according to M.P.E.P. § 2142. Claim 1 teaches a combiner that reflects a first portion of display light, rotates the

polarization of the second portion of the display light, and transmits the second portion of the display light, and the combiner of claim 1 is positioned between the occupant of a vehicle and the vehicle's windshield. McDonald's combiner is the windshield. Donath's combiner does not rotate the polarization of display light. The combination of Donath and McDonald therefore does not produce a combiner positioned between the windshield of a vehicle and the occupant of a vehicle that rotates a polarization display light. In short, the Examiner has failed to make a *prima facie* case of obviousness citing McDonald and Donath.

Weber, like McDonald, embeds a light-polarization-related object within a windshield. Figure 2 of Weber clearly shows that Weber's reflective polarizer (20 in Figure 2) is embedded within a window or windshield (18 in Figure 2). However, in Weber, *p*-polarized light is issued from a display source (12 in Figure 2) for efficient transmission through the inside and outside surfaces of the window. Weber's embedded reflective polarizer (20 in Figure 2) reflects a portion of the *p*-polarized display light back to the viewer. However, Weber's reflective polarizer (20 in Figure 2) does not efficiently transmit *s*-polarized light (32 in Figure 2) from external sources, and thus acts as a filter, much like polarizing sunglasses, to prevent glare from external sources reaching the occupant of the vehicle. Continuing with the combination of references, discussed above, Weber adds absolutely nothing to a combination of McDonald and Donath. Like McDonald, Weber uses a polarized-light-related entity embedded within the windshield. Weber does not use a separate combiner. Furthermore, Weber's polarizing reflector (20 in Figure 2) does not rotate the polarization of either the display light or of external light. Instead, it transmits *p*-polarized light from the display source back to the viewer and absorbs *s*-polarized light from external sources. As in the case of McDonald, discussed above, there is no operable or reasonable way to combine Weber with Donath, since Donath does not use a polarized light source and does not incorporate a polarization rotator within Donath's combiner. Similar to the above discussion of combining McDonald with Donath, a combination of Donath with Weber produces a two-combiner system that would guaranteed ghost images that are sought to be avoided both by McDonald's device and the combiner claimed in claim 1 of the current application. As

with a combination of McDonald and Donath, discussed above, there is no suggestion in McDonald, Weber, or Donath for combining the device disclosed in any of the cited references with the disclosed devices of the other cited references. There is absolutely no workable combination of McDonald and Weber, since McDonald employs an *s*-polarized display-light source, and Weber employs a *p*-polarized light source. There is no combination of Donath's combiner, which does not include a polarization rotator, with either of McDonald or Weber, since any such combination would end up reflecting a display-light source both from Donath's external combiner and from the inside windshield surface, producing ghost images. Finally, no combination of McDonald, Donath, and Weber teaches all of the limitations of claim 1, since neither McDonald nor Weber teaches, mentions, or suggests a combiner separate from the windshield, and Donath's separate combiner does not include a polarization rotator.

Sebastiano is a very simple patent that is directed to glass for motor vehicle windshields that is coated with a transparent, multi-layered coating. There is no mention or suggestion in Sebastiano that Sebastiano's multi-layered coating has any effect on the polarization of light passing through the multi-layered coating. Sebastiano also does not teach, mention, or suggest polarized light sources, problems with ghost reflections, or anything else related to the current application. The combination of Sebastiano with either McDonald or Weber would, in the most favorable conditions, not produce the slightest change in operation of McDonald's and Weber's devices. At worst, an additional coating on a windshield may produce a change in the reflectivity of the windshield and thus a change in the reflection of display-light-source light back to the viewer or vehicle occupant, generally upsetting the balance of reflected display-light-source light and light transmitted through the windshield from the external environment.

With regard to the Examiner's rejection of claims 1, 2, 7, 9-12, 15-17, and 21 over McDonald in view of Donath, Applicants' representative has pointed out that a proposed combination of McDonald and Donath is nowhere suggested in either McDonald or Donath, unworkable, and does not produce a combiner, separate from the windshield, that includes the ability to rotate the polarization of display-light-source light, as clearly claimed in independent claim 1 and independent claim 15. In rejecting claim

21 the Examiner states that McDonald teaches "a relay optic that rotates the polarization of the reflected, first portion of the display light to direct *p*-polarized light to the vehicle occupant, lines 5-25 of column 3." This is not true. Nowhere in the cited portion of McDonald is a relay optic taught, mentioned, or suggested. Instead, in the cited paragraph, McDonald discusses the fact that using *s*-polarized imaging light-source illumination with a combiner comprising the inside windshield air interface and a half-wave retarder within the windshield significantly reduces reflection from the outside windshield air interface. There is simply no mention of a separate relay optic such as relay optic 908 in Figure 9 of the current application. The terms "relay optic," "relay," and "optic" do not occur in this paragraph, and there is no mention in the paragraph of an optical element separate from McDonald's half-wave-retarder containing windshield.

The Examiner rejects claims 3, 4, and 8 over McDonald in view of Donath and Weber. As discussed above, there is no operable combination of these three references. Moreover, the Examiner states that Weber teaches "the combiner consists of a birefringent material" in paragraphs [0041] and [0042] of page 4. Weber elsewhere describes this reflective polarizer as a partially transmissive beam splitter, as discussed above. It does not change the polarization of impinging light. No combination of McDonald, Donath, and Weber produces a combiner separate from the windshield that rotates the polarization of impinging polarized light.

In rejecting claims 5, 6, 10, 13, 14, 19, and 20 as being unpatentable over McDonald in view of Donath and in further view of Sebastiano, the Examiner states that Sebastiano et al. teaches "the combiner is coated with a dielectric film." Sebastiano teaches nothing of the sort. Instead Sebastiano teaches that a windshield may be covered by a multi-layer transparent coating so that the windshield itself, along with the coating, has the combined capabilities of sun radiation screen and image combiner. However, as discussed above, Sebastiano does not teach, mention, or suggest any effects of the multi-layer coating with regards to polarized light. Sebastiano also fails to teach, mention, or suggest a polarized display-light source. Applying Sebastiano's coating to McDonald's windshield does not produce a useful combination. Applying Sebastiano's multi-layer coating to Donath also does not provide a useful combination. While Sebastiano's multi-

layer coating may provide efficient reflection of *p*-polarized light as in Applicants' claimed dielectric coating, McDonald uses *s*-polarized light, and Donath does not use polarized light. Were McDonald to use *p*-polarized light, then there would be no use for McDonald's embedded half-wave retarder. Donath's combiner used in combination of Sebastiano and McDonald would produce reflection both from Donath's combiner and from the inside windshield, leading to the very ghost images that both McDonald and the currently claimed combiner seek to ameliorate or prevent altogether. The combination makes absolutely no sense.

In summary, the Examiner has failed to make a *prima facie* case of obviousness, according to M.P.E.P. § 2142, with respect to any of the Examiner's cited combination of references. McDonald and Weber cannot be combined. McDonald uses *s*-polarized light and an embedded half-wave retarder, while Weber uses *p*-polarized light and an embedded reflective polarizer. These two systems operate on entirely different principles. Moreover, neither employs a separate combiner, but, instead, McDonald employs an outside or inside surface of a windshield as a combiner, and Weber employs a partially transmissive beam splitter embedded in the windshield. Neither Donath nor Sebastiano teach, mention, or suggest anything at all related to polarized light or manipulation of the polarization state of light sources. Neither Donath nor Sebastiano is concerned with reducing or eliminating ghost reflections. Of all four cited references, only Donath teaches a combiner separate from a windshield, and Donath's combiner does not include a polarization rotator and does not reflect a portion of a polarized light source. No combination of McDonald, Weber, Donath, and Sebastiano produces a discrete combiner, separate from a windshield, that includes a polarization rotator, such as the combiner of claims 1 and 15. No combination of the cited references produces a combiner separate from the windshield with a metallic or dielectric film. No combination of any two or more of the four cited references produces a head-up display system with more favorable characteristics than that disclosed by any single reference, and almost all combinations are either defective or unworkable.

In Applicants' representative's opinion, all the claims remaining in the current application are now clearly allowable. Favorable consideration and a Notice of Allowance are earnestly solicited.

Respectfully submitted,
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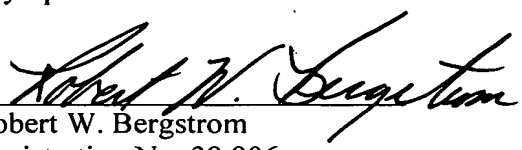

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